Design Memo 16-04

Designer Summary of Required Utility Relocations – Project Design and Utility Summary

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Session Overview

Project Design & Utility Summary

- **Ultimate goal – successful delivery of our proposed project**
  - On time and on budget
- **Utilities can be an intricate part of your project delivery**
  - Open to traffic commitment next year

    Can your project absorb 12 months of utility relocation work, build the project, & open to traffic
  - How about $1 million relocation
    - Utility have the money
    - Reimbursable - does your project have the money

Why Design Around Utilities

- Current Utility Coordination paradigm (IDM 104)
- Reinforced – INDOT Open Roads Program Guide
- Utilities are a long term business partner within existing public right-of-way and/or along them
- Utility stakeholders – almost all of us; same stakeholders that are funding our road/bridge projects

Designing around Utilities

- **Establish <u>viable</u> options to deliver the project**
  - Utility relocation options
  - Project design around options
  - Develop a decision matrix to be able to make informed decisions
  - Focus
    - Integrity of the project – purpose/need & capital investment
    - Safety of the traveling public

Develop design / utility decision matrix

- **Design and Utility Summary Table**
  - Documentation tool
    - Project_Design_and_Utility_Summary_Table (INDOT Utility Coordination\Standard Documents – General)
  - Roadmap to solutions and final decisions
    - Advantages and Disadvantages for Utility relocation vs. Design around
      - Environmental impact, R/W, Constructability, Project Schedule, and Project Cost
    - Expand to add details – critical points table

Example Design/Utility matrix

- **Project Description**

			Utility Coordinator		
Designer's Justification To Impact The Utility	Design Around Alternative description*	Design Around Estimated Cost*	Utility Relocation Plan	Estimated Utility Relocation Cost	Utility Relocation Reimbursable
Proposed design meets the current Purpose and Need of the project; To design around the utility, there is substantial project impact of additional R/W and Construction cost.	Leave utility in place by constructing a slightly graded foreslope to provide cover over the utility, then construct the open ditch further away from the roadway; substantial project impact of additional R/W and Construction cost	$200,000 of additional R/W and Construction costs	Substantial cost and time to relocate - prefer to stay in place; Relocate to 5 ft inside proposed R/W	$1,200,000	No

Example Design/Utility matrix

- **Project Team Collaboration**

Project Team Collaboration										
Environmental Impact		Right-of-Way Impact		Constructability Impact		Project Schedule Impact		Project Cost Impact		Recommended Resolution
Design Around	Utility Relocation	Design Around	Utility Relocation	Design Around	Utility Relocation	Design Around	Utility Relocation	Design Around	Utility Relocation	
CE/NEPA document Additional Information required to account for 0.7 acre of additional R/W; No additional impacts expected after environmental coord. (no waterways, wetlands, historic in area)	No additional impact (area already covered in CE/NEPA doc.)	2 parcels impacted for a total of 0.7 additional acres permanent R/W	No additional R/W required	None	R/W must be clear & staked prior to notice to proceed issued for utility work	Approx. 20 additional days to construct design around option (additional fill and stormwater structures)	11 months after N.T.P issued	$200,000	$1,200,000 non-reimbursable	**Design Around Option chosen; Utility enters into agreement to pay $200,000 Design Around Option; Saves the Utility $1,000,000; Saves 10 months during construction**

How to implement

- **<u>Early</u> and effective communication**
  - Commitments from Utilities, UC, Designers, PM…..*Don't forget Construction*
  - Project development timelines & expectations
  - Essential to identify critical points early
  - Realize this will be an iterative process of sharing information back and forth
  - Plan for Design flexibility

Project Kick Off

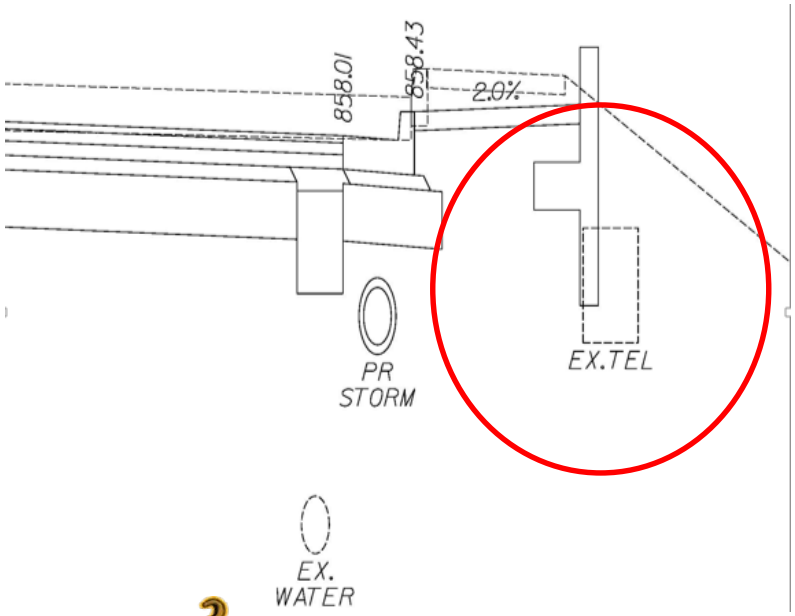
- **Review proposed Design footprint vs existing utilities**
  - Critical Design elements – bridges, stormwater trunkline, underdrains, etc.
  - Critical Utility features: not just lines in the survey
    - Vaults, duct banks, overhead electric with clearance restrictions, etc.

Critical Facilities

Critical Facilities

Effective SUE strategy

- **Develop a design envelope around utilities**
- **What additional utility information is needed?**
  - 811 locates surveyed....+/- 2 ft horizontal
  - Depths/elevation known by the Utility Company



Effective SUE strategy

- **Develop a SUE strategy to gather more accurate location information**
  - Narrow down the design envelope
- **Communicate SUE specific required information**
  - Underground conduit duct bank – need all 4 corners, top left/right with bottom of critical side?
  - QL-B – Electromagnetic wand (EM) & Ground Penetrating Radar (GPR)
    - +/- 6 inches Horizontal and Vertical
    - Limitations
  - Critical location – no margin/wiggle room
    - QL-A/pot hole with details surveyed

Critical Table: One Example

Test Hole	Station	Ground Surface	Depth of Duct (ft.)	Top of Duct Elev.	Str. No.	Pipe Flow Line Elev.	Pipe Diameter (inch)	Pipe Thickness (ft.)	Bottom of Pipe Elev.	Top of Pipe Elev.	SEPERATION (ft.)	Amount to be Lowered (inches)	Max. Elevation
1	16+86	854.72	5.58	849.14	2405	848.50	12	0.23	848.27	849.73	-0.87	36	846.0
2	18+17	852.23	5.67	846.56	2409	848.00	15	0.25	847.75	849.50	1.19	12	846.0
3	20+16	850.08	5.50	844.58	2415	845.30	18	0.27	845.03	847.07	0.45	18	843.0
4	21+79	851.03	5.42	845.61	2421	843.40	15	0.25	843.15	844.90	-2.46	54	841.0
5	24+16	850.96	5.58	845.38	2428	843.60	18	0.27	843.33	845.37	-2.05	48	841.0
6	27+00	848.53	4.75	843.78	2425	843.90	12	0.23	843.67	845.13	-0.11	30	841.0
7	28+31	848.16	4.67	843.49	2426	844.30	12	0.23	844.07	845.53	0.58	18	842.0
8	28+47	848.08	5.08	843.00	2429	842.80	18	0.27	842.53	844.57	-0.47	30	840.0
9	12+20	849.46	5.33	844.13	2503	845.00	12	0.23	844.77	846.23	0.64	18	843.0
10	12+85	850.00	4.67	845.33	2507	845.20	12	0.23	844.97	846.43	-0.36	30	843.0
11	14+00	850.70	4.33	846.37	2505	846.60	12	0.23	846.37	847.83	0.00	24	844.0

NOTE: SEPERATION is the distance between the top of duct and the bottom of storm pipe; negative # means the duct is up into the pipe.
All ducts are too close to remain without being lowered.
Pipe thickness taken from INDOT Design Manual Figure 28-6Q for RCP

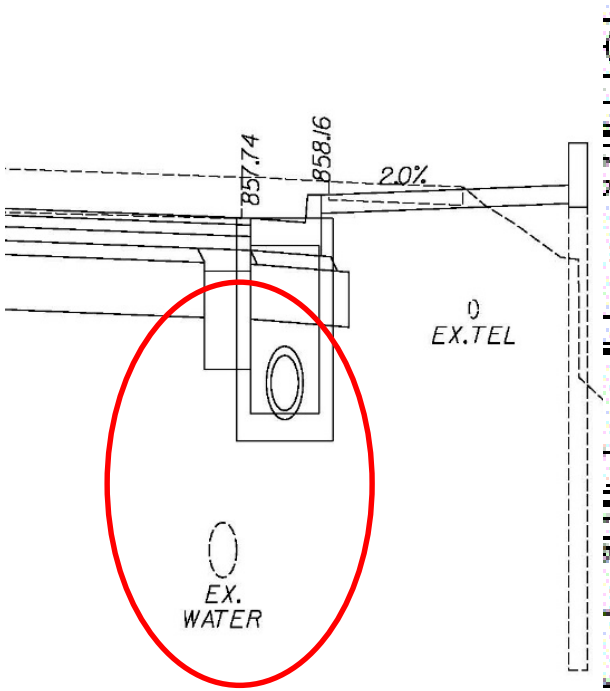
U.S. 31 Hamilton County

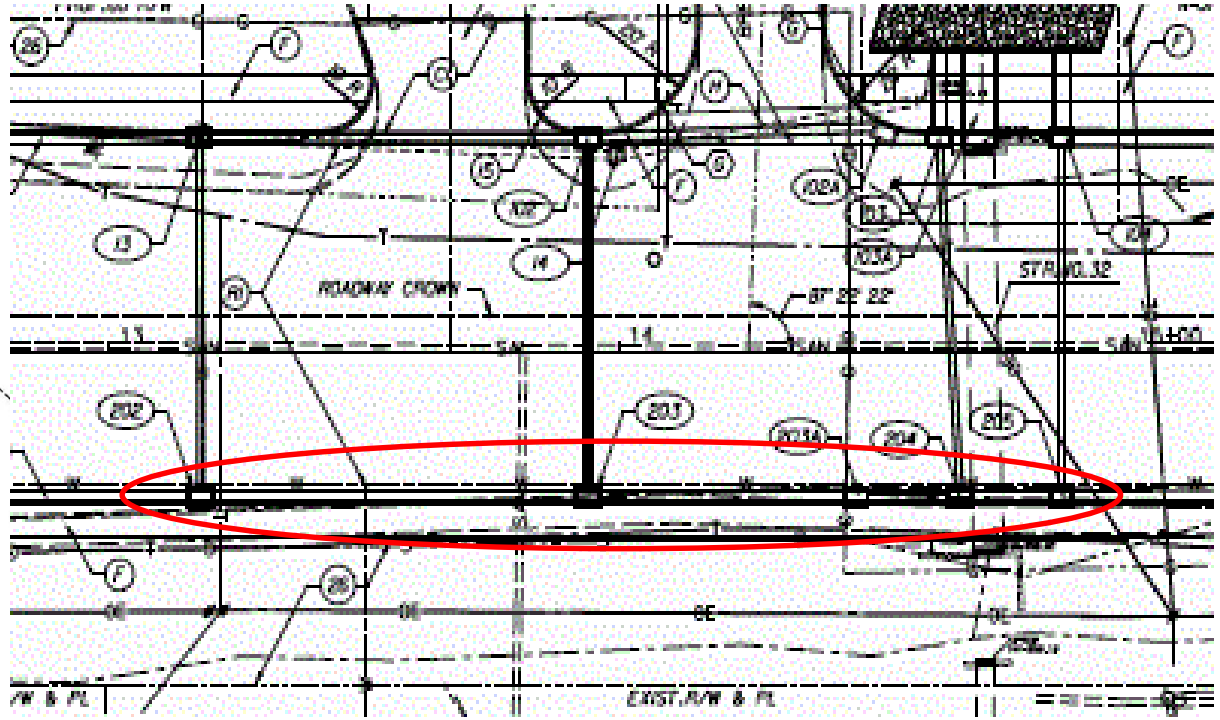
116th St. & Pennsylvania St. - AT&T Indiana duct run test hole data

Review-Revise-Repeat

- Update utility information in models
- Re-plot in plans and cross sections
- Incorporate change capability into design
- Identify potential alternatives
- Develop cost-benefit scenarios
- Review changes with facility owners
- Discuss options/motivations of facility owners

Review-Revise-Repeat



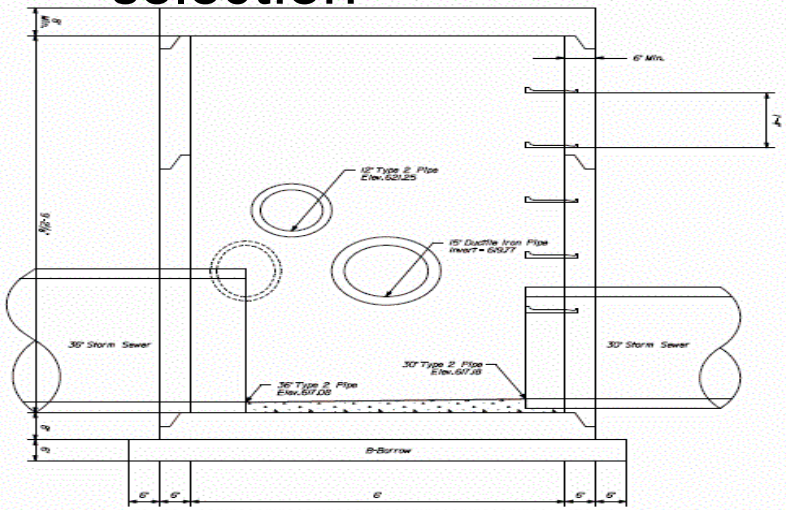


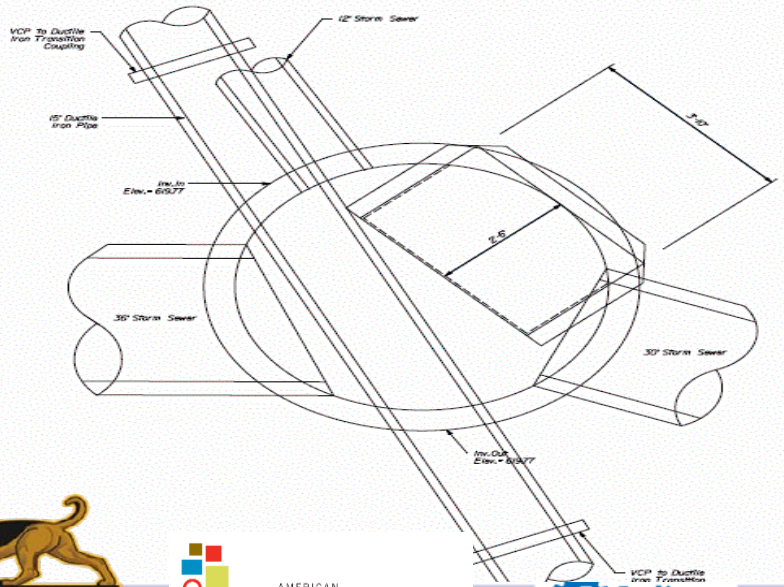
Design Techniques/Alternatives

- Designing and Constructing Around Utilities
  (INDOT Utility Coordination website – References)
- Relocate/revise storm sewer configuration
- Revise inlet/manhole selection
- Incorporate multiple trunklines
- Add flexibility into the design
- Realign/relocate bridge piers/abutments
- Revise signal layout
- Revise retaining wall configuration
- MSE wall – excavation/strap length...support facilities

Conflict Remediation

- Design conflict structure
- Create a utility cradle
- Develop underground bridging slab
- Modify subgrade treatment selection
- Alter MOT Plan
- Hold facilities in-place during construction
- Splay duct banks





811 compared with SUE

- **Isn't 811 the same as QLB?**
- **The one critical question you have to answer?**

LPA & Local Project Application

- **LPA Projects**
  - Still follow IDM & Associated Design Memos
  - Coordinate SUE with the Project Owner at the beginning of the project
  - Mitigates overall risk on cost and time
- **Local Projects**
  - Time is typically driving factor
  - Conflict Analysis & Matrix helps identify risk early on

Design Alternatives

- Concrete capping of shallow facilities
- Using water quality pipe for storm sewers close to water lines
- Bridging facilities through an MSE wall or retaining wall
- Spanning fuel lines
- Using curb turn outs

Project Examples

- **Pennsylvania & City Center Drive**
  - Carmel Bond Project
  - Locally Funded
  - Design started in March
  - Construction completed by end of 2016
  - Design alternatives were the rule, not the exception

Utilization of Conflict Matrix

	A	B	C	D	E	F	G	H	I	J	K
19	UTILITY PARTNER	CONTACT	CONFLICT ID	SHEET NO	UTILITY TYPE	OH/UG	MATERIAL	SIZE	TYPE OF CONFLICT	BEGIN STA	BEGIN OFFSET
20			1627-16	7	F/O	UG	Conduit	2 x 1"	Storm	14+87	43'
21	CATV		1627-15	7	Cable	UG	Jacketed	1"	Storm	14+87	43'
22	AT&T		1627-14	7	Cable	UG	Jacketed	1"	Storm	14+84	38'
23	Windstream		1627-13	7	F/O (Duct Bank)	UG	Conduit	1"	Storm	14+80	30'
24	MCI		1627-12	7	F/O	UG	Conduit	3 x 1"	Storm	14+78	29'
25	Brighthouse		1627-11	7	Cable	UG			Storm	14+78	29'
26	CATV		1627-10	7	Cable	UG	Conduit	2"	Storm	14+75	22'
27	City of Carmel		1627-42		Water (Unknown)	UG			Storm Str	14+77	27'
28	Vectren		1627-9	7	Gas	UG	Plastic	2"	Storm	14+70	20'
29	AT&T		1627-43		F/O (Unknown)	UG	Conduit	1"	Underdrain	14+57	51'
30	Vectren		1627-23	7	Gas	UG	Plastic	2"	Underdrain	14+50	65'
31	CATV		1627-24	7	Cable	UG	Conduit	2"	Underdrain	14+45	72'
			1627-25	7	D.O.T. F/O	UG	Conduit	2 x 4"	Underdrain	14+30	95'

Instructions | Blank Matrix

Utilization of Conflict Matrix

R/L/X	LINE	QL A OR B	SURVEY ID NUMBER	DEPTH	SURFACE SURVEY ELEVATION	UTILITY ELEVATION	IMPACT REQUIRED (Y/N) & EXPLAIN	ALERNATIVES EXPLORED	RE-DESIGN ESTIMATED COST
	"A"		12059	2.72	851.57	848.85	N - behind prop. storm		
	"A"		12060	2.6	852.34	849.74	N - above prop. storm (1')		
	"A"		12061	2	852.55	850.55	Y - in Pavement	Lower line w/o impact (at bottom of pvm't. w/ current design)	
	"A"		12062	2.5	852.90	850.40	Y - in Pavement	Lower line w/o impact (at bottom of pvm't. w/ current design)	
	"A"		12063	5.08	852.89	847.81	N - Storm Revised to avoid		
	"A"		12064	> 6.2 ft.	852.71	-	Did not find utility - No conflict		
	"A"		12065	3.57	852.91	849.34	N - above prop. storm (0.75')		
			12066	> 7 ft.	852.64	-	Did not find utility - No conflict		
	"A"		12067	2.49	852.63	850.14	N - above prop. storm (1')		
			12068	1.82	851.54	849.72	Y - too shallow for UD	no underdrain	none
			12069	3.01	851.68	848.67	Y - too shallow for UD	no underdrain	none
			12070	2.36	851.61	849.25	Y - too shallow for UD	no underdrain	none
			12071	1.35	851.15	849.80	Y - too shallow for UD	no underdrain	none

Instructions | Blank Matrix

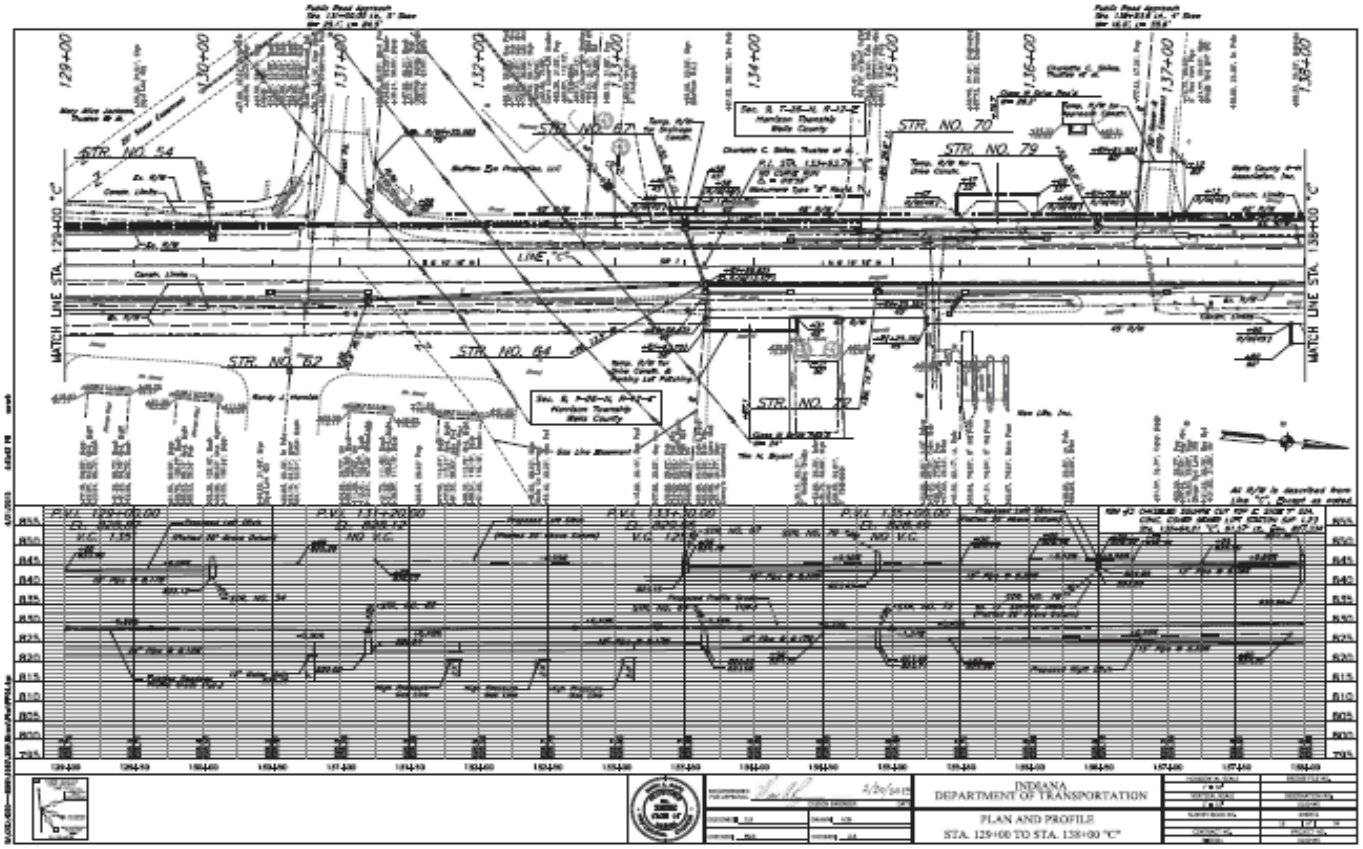
Results & Lessons Learned

- Removed all Underdrain
- Utilized existing storm sewers & structures
- Minimal utility relocations
- Caution – potholing yields a “snapshot” at a particular location

Design Around

- **SR 1**
  - Four Interstate gas transmission lines in their own easement
    - Relocation would have been about $2Million and the project construction cost was only $2.9Million
    - Depths were established and the storm sewer was designed around those gas facilities

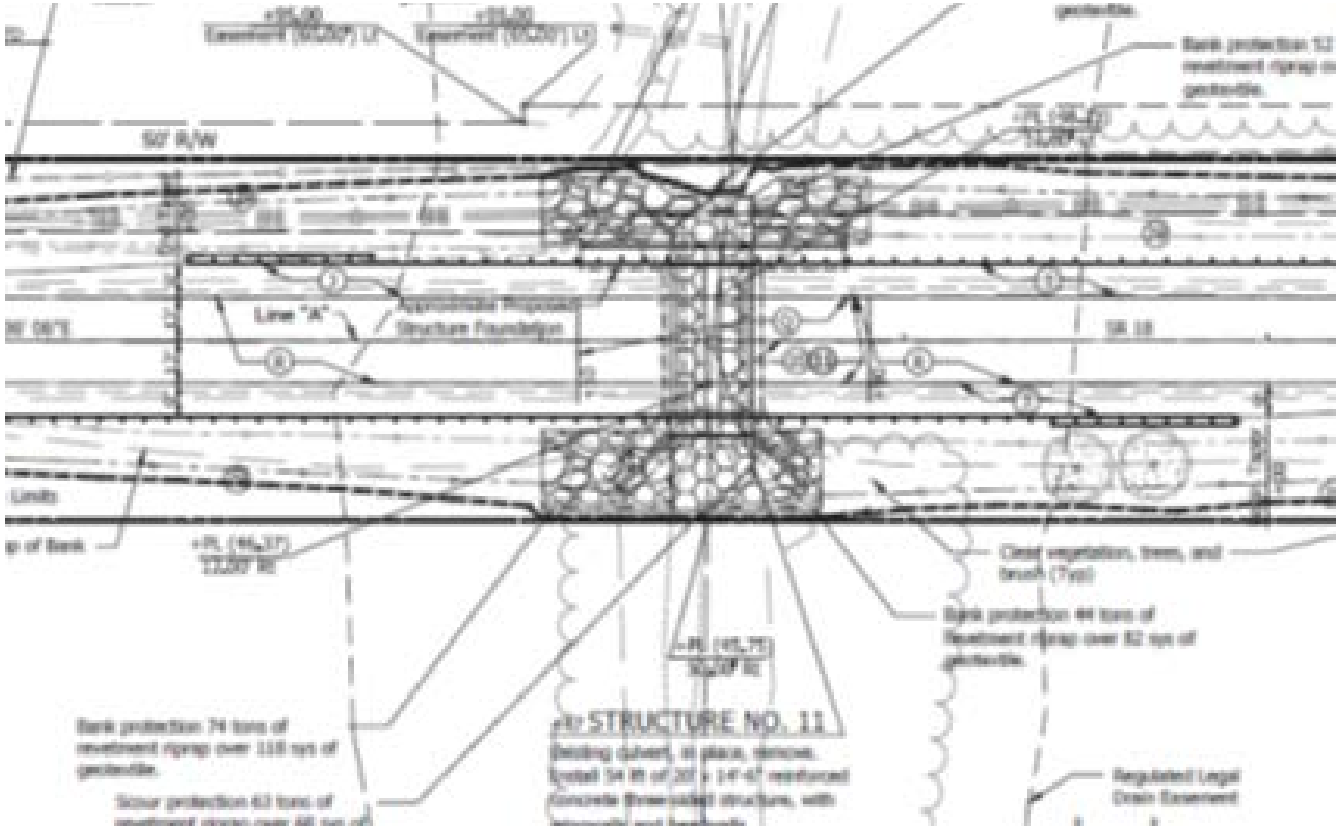
Design Around



Design Changes

- **Small Structure SR 18**
  - Wing wall Geometry
  - By changing the angles on the wing walls we were able to pull back away from a 8” natural gas main

Design Changes



Unique Special Provisions

- **Electric Transmission**
  - Relocation can sometimes be cost prohibitive
  - When this occurs we discuss the possibility of outages
  - Upside- Economic feasibility
  - Downside- May cause off hours construction work and may be weather dependent

When You Shouldn't Design Around Utilities

- **Aging Facilities**
  - How old is that sewer main?
  - Will I not get my return on this investment?
- **Constructability**
  - Can I use a vibratory roller over that gas main?

Summary

- **Original goal?**
  - Successful delivery of our proposed project
    - On Time
    - On budget
  - Designing around utilities
    - Establish **viable** options to deliver the project
    - Keys to success
      - Early communication
      - Design flexibility
      - Develop a decision matrix to be able to make informed decisions

Question and Discussion

Thank you